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Contribution to the floristic knowledge of Lipari and Panarea Islands (Sicilia, Italy)

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Abstract

The inventory of the taxa collected in 2022 during the annual field trip of the Working Group for Floristics, Systematics and Evolution of the Italian Botanical Society is reported. The field trip was held from 19th to 22th April in the islands of Lipari and Panarea (Aeolian Islands, Sicilia). Overall, 1,664 herbarium specimens were deposited in public and private herbaria. The flora documented for the studied area amounts to 386 specific and subspecific taxa, belonging to 241 genera and 74 families. *Centaurea aeolica*, *Helichrysum litoreum* (Asteraceae), and *Dianthus rupicola* subsp. *aeolicus* (Caryophyllaceae) were the

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only three Italian endemics found in the study area, whereas 48 alien taxa were recorded. *Dimorphotheca ecklonis* (Asteraceae), *Nassella tenuissima* (Poaceae), *Solanum torvum* (Solanaceae), and *Viola wittrockiana* (Violaceae) are casual alien species new to Sicilia, whereas *Oenothera odorata* (Onagraceae) is a new naturalized alien species for the Italian vascular flora.

Keywords
Aeolian islands, alien species, biodiversity, endemics, floristic novelties, vascular flora

Introduction

The Working Group for Floristics, Systematics and Evolution of the Italian Botanical Society (SBI) has been active in increasing the floristic knowledge of Italy by organizing, since 20 years, floristic excursions dedicated to poorly explored areas and publishing the results (e.g., Conti et al. 2006; Bartolucci et al. 2019; Stinca et al. 2019; Roma-Marzio et al. 2020 and literature cited therein). The selection of the territories to be investigated is usually based on the low number of published floristic studies, as summarized in the map of floristic knowledge of Italy (Scoppola and Blasi 2005). Herein, we present the results of the field trip held in 2022 in Lipari and Panarea, two Aeolian islands investigated by botanists since the first half of the 19th century, but for which complete and updated floristic data are lacking.

Indeed, Giovanni Gussone reported in his Florae Siculae Prodromus (Gussone 1827–1834) and Florae Siculae Synopsis (Gussone 1842–1845) several plant records from all the seven main Aeolian islands. Michele Lojacono-Pojero in 1877 and in 1902 explored the islands of Salina, Lipari, Vulcano, Panarea (and its surrounding islets) and Stromboli (Lojacono-Pojero 1878, 1904). Giuseppe Zodda visited the same islands in 1902 (Zodda 1904). Although outdated, comprehensive lists of the flora and vegetation for the islands of Alicudi, Vulcano and Stromboli (Ferro and Furnari 1968a, b, 1970; Di Benedetto 1973) are available; a map of the vegetation of Filicudi with an annexed floristic list was published by Longhitano (1983). A summary of punctual contributions on individual areas, taxonomic groups or floristic notes is also available in Lo Cascio (2017a).

Gioachino Ferro, from the University of Catania (Sicily), dedicated a large part of his life to the study of the flora and vegetation of this archipelago but his passing away stopped the publication of the summary of his research. Several analyses based on data regarding the flora of this archipelago have been published (Pasta and La Mantia 2013; Celesti-Grapow et al. 2016; Zannini et al. 2018; Pasta et al. 2019; Chiarucci et al. 2021) but any without providing accessible floristic lists. Actually, the floras of Lipari, Salina and Panarea are still unpublished. The Wikiplantbase #Sicilia database (Domina et al. 2016 [onwards]) hosts only 262 and 107 floristic records for Lipari and Panarea, respectively. In 2022, with the aim of improving the knowledge on the flora of the islands of Lipari and Panarea, an excursion of the Working Group for Floristics, Systematics and Evolution of the SBI was organized on these islands.

Materials and methods

There were 18 active participants: Enrico Bajona, Giulio Barone, Fabrizio Bartolucci, Laura Cancellieri, Giuseppe Caruso, Fabio Conti, Alessandro Crisafulli, Giannantonio Domina, Simonetta Fascetti, Jacopo Franzoni, Antonio Giacò, Valentina L.A. Laface, Lorenzo Pinzani, Leonardo Rosati, Anna Scoppola, Adriano Stinca, Agnese Tilia, and Daniele Viciani and six guests (Suppl. material 1).

Study area

Lipari and Panarea are currently two quiescent volcanic islands although there is a weak hydrothermal activity in the western part of Lipari and active submarine fumaroles about 2.5 km east of the coast of Panarea. Both islands fall within the thermo-Mediterranean belt with a dry-humid climate (Bazan et al. 2015). There are prehistoric remains that place the first phase of human colonization of the Aeolian Archipelago starting from the 5th millennium BP (Lo Cascio 2017b). The first profound modifications of the territory occurred during the Greek and Roman colonization. Until the early 20th century, most of the islands' surface was cultivated. In the mid-nineteenth century, the Aeolian Islands had about 21,000 inhabitants, almost double the current residents, and agriculture was the main activity (Cavallaro 1987). Today the cultivated area is around 15% in Lipari and 5% in Panarea, also including the ornamental greenery and the small, cultivated areas in and around the settlements (data obtained from aerial images). A gradual recolonization of natural vegetation has begun in the abandoned lands. The potential vegetation, where the soil is deeper, is represented by *Quercus ilex* L. woods with the presence of *Erica arborea* L. The remains of this vegetation are very limited. Small strips of deciduous oak woods are also present. Anthropic action has determined regression processes of the vegetation favouring the development of maquis with *Erica arborea* and *Arbutus unedo* L. and garrigues with *Cistus* sp. pl. and *Genista tyrrhena* Vals. subsp. *tyrrhena*. The maquis with *Euphorbia dendroides* L. occurs on the lithosols. On sunny slopes, prairies with *Hyparrhenia sinaica* (Delile) Llauradó ex G.López or *H. hirta* (L.) Stapf subsp. *hirta* and, scattered, *Genista tyrrhena* dominates. On the cooler slopes, prairies with *Brachypodium retusum* (Pers.) P.Beauv. are dominant. The coasts are mainly rocky, while beaches are localized and of modest extension. During the excursions, we crossed synanthropic vegetation near inhabited centres, cultivated fields in agricultural areas for collecting weeds and semi-natural vegetation of prairie, garrigue and scrub in non-cultivated lands.

Lipari is the largest of the Aeolian Islands (37.2 km^2) and, like the others, it is made up of various volcanic formations composed of a large variety of volcanic rock types (Forni et al. 2013). It reaches 594 m a.s.l. on Mount Sant'Angelo. The most common soils are ever-changing regosols and lithosols. More than 660 taxa are documented for the island, 14% of which are alien to the Italian territory (Chiarucci et al. 2021). Panarea extends for 3.3 km^2 and reaches a height of 420 m a.s.l. It is composed of andesitic to dacitic as well as of rhyolitic rocks (Stanulla et al. 2017). Almost 440 taxa are known for the island, 12% of which are alien to Italy (Chiarucci et al. 2021).

Data collection

With the aim of optimizing the sampling, five excursions were planned in order to: (a) maximise the environmental heterogeneity among sampling sites, (b) explore areas of scarce floristic knowledge, and (c) include the area of high naturalistic value (Lo Cascio and Pasta 2004) (Table 1). Three excursions were performed in the southern, western and northern parts of Lipari and one in the southern part of Panarea; the village of Lipari and its surroundings were investigated during the last day (Fig. 1, Table 1).

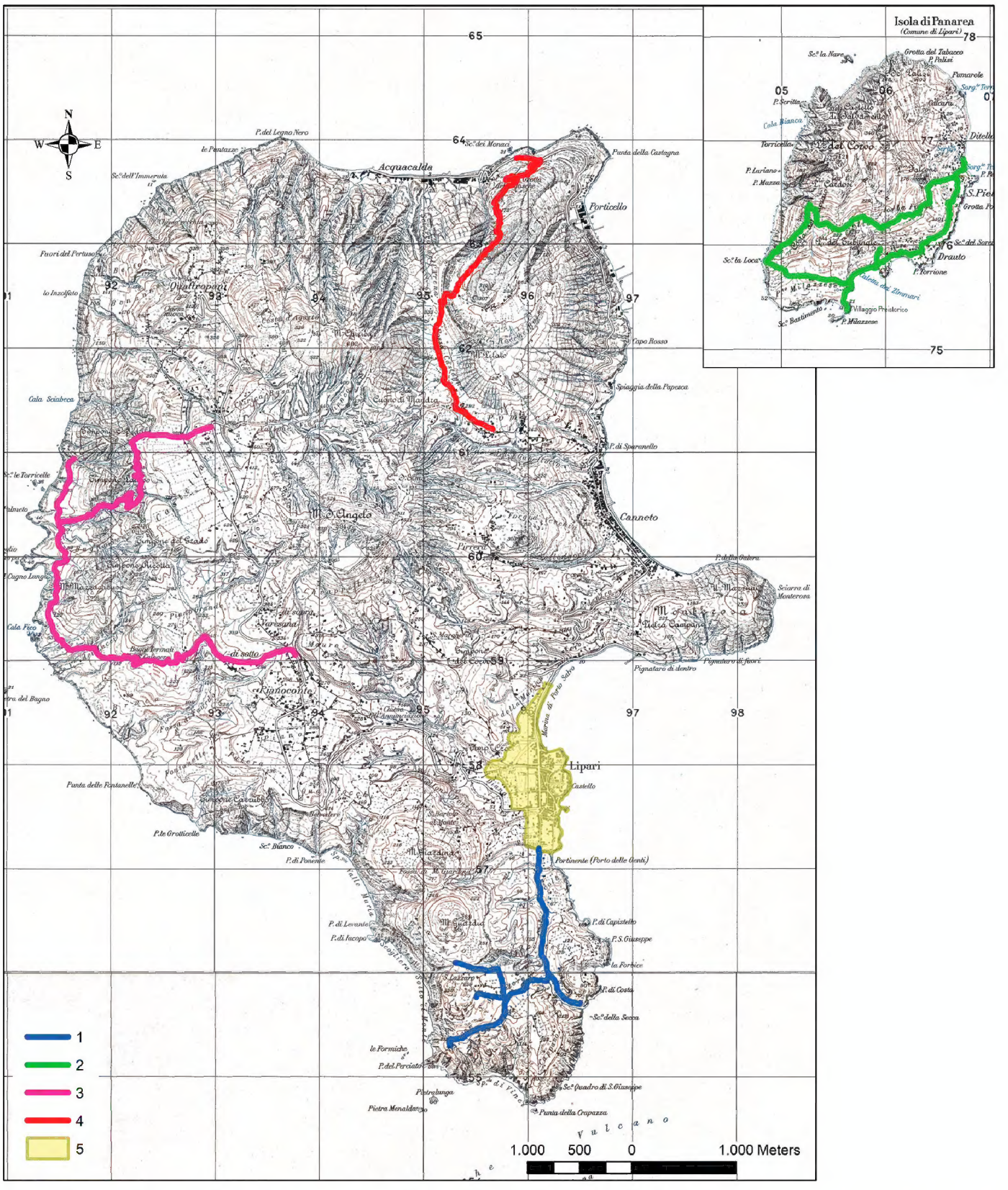

Figure 1. Study areas and localization of the excursion itineraries. For details on the sample sites, see Table 1.

Table 1. List of sampling sites, with reference number, locality name, geographic coordinates, altitude range, main habitats, and date of collection.

ID	Locality name	Start point (WGS84)	End point (WGS84)	Length (km)	Altitudinal range (m a.s.l.)	Main habitats	Date
1	Lipari, southern part of the island	38.460829°N, 14.954650°E	38.443654°N, 14.945286°E	3.9	5–220	dry stone walls, maquis, roadside, uncultivated land, trail	19 April 2022
2	Panarea, southern part of the island	38.637883°N, 15.077146°E	38.634164°N, 15.059745°E	5.6	0–260	inhabited area, dry stone walls, uncultivated land, uncultivated sandy land, cliff, cliff facing the sea, beach, trail	20 April 2022
3	Lipari, western part of the island	38.497938°N, 14.918653°E	38.477423°N, 14.928274°E	6.8	50–380	dry stone walls, trail, escarpment, uncultivated land, olive grove, roadside	21 April 2022
4	Lipari, northern part of the island	38.521090°N, 14.952329°E	38.497234°N, 14.950102°E	3.8	50–350	dry stone walls, wet ground, maquis, uncultivated, cultivated, slope, roadside	22 April 2022
5	Lipari, village	38.474946°N, 14.955492°	38.460829°N, 14.954650°E	≈ 4.0	0–30	flower beds, sidewalk, dry stone walls, concrete walls, roadside, uncultivated land	22 April 2022

Plant identification

Herbarium specimens prepared are deposited in public and private herbaria (Suppl. material 2). Each participant drafted a list of the species collected during the excursions and later identified. As done during previous excursions, the coordinator of the Working Group merged the floristic lists and organized a workshop to revise critical collections and unidentified specimens at the Herbarium Mediterraneum Panormitanum of the University of Palermo on February 22th–24th 2023.

The nomenclature of taxa mainly follows the updated checklists of the vascular flora native (Bartolucci et al. 2018) and alien (Galasso et al. 2018) to Italy and subsequent updates summarised in the Portal to the Flora of Italy (2023, see also Martellos et al. 2020). The exceptions are commented in the floristic list (Suppl. material 3). In the floristic list, families are divided into "Ferns and Fern allies", "Gymnosperms", "Angiosperms, Dicots", "Angiosperms, Monocots" and ordered alphabetically; genera, species and subspecies are ordered alphabetically. For each taxon, the following information is reported: endemic, cryptogenic or alien status, sampling locality, herbarium in which the collection is preserved (Suppl. material 2). Abbreviations or symbols used in the floristic list are: **E** = Italian endemic (according to Peruzzi et al. 2014; Bartolucci et al. 2018; Portal to the Flora of Italy 2023); **A** = Alien taxon and its status in the observed localities: **CAS** (casual), **NAT** (naturalized), **INV** (invasive); **C** = Cryptogenic taxon (doubtfully native taxon, whose origin of occurrence in Italy is unknown); **N** = New record for the flora of Sicilia.

A list of species new to Lipari and Panarea is not provided due to the lack of updated and specific floristic lists for these two islands.

Results

After the field trips a total of 1,664 herbarium specimens were prepared and identified, belonging to 386 species and subspecies, 241 genera, and 74 families (Suppl. material 3, 4).

Centaurea aeolica Guss. ex Lojac., *Helichrysum litoreum* Guss. and *Dianthus rupicola* Biv. subsp. *aeolicus* (Lojac.) Brullo & Miniss. were the only three Italian endemics found in the study area.

A total of 48 alien taxa were recorded (12.4%), 20 of which are casual, 26 naturalized and two invasive (i.e. *Ailanthus altissima* (Mill.) Swingle and *Oxalis pes-caprae* L.). Noteworthy is the discovery of *Oenothera odorata* Jacq. (Onagraceae) (Fig. 2A), a naturalized species new to Italy, as well as, *Dimorphotheca ecklonis* DC. (Asteraceae) (Fig. 2B), *Nassella tenuissima* (Trin.) Barkworth (Poaceae) (Fig. 2C), *Solanum torvum* Sw. (Solanaceae) (Fig. 2D), and *Viola wittrockiana* Gams ex Nauenb. & Buttler (Violaceae) new to Sicilia.

Figure 2. A *Oenothera odorata* from site 1 **B** *Dimorphotheca ecklonis* from site 1 **C** *Nassella tenuissima* from site 3 **D** *Solanum torvum* from site 4. For details on the sample sites, see Table 1. Photographs by G. Domina.

Discussion

Among the 386 species and subspecies identified in this work, only *Centaurea aeolica* is exclusive of the Aeolian archipelago. Concerning the other two endemics, *Dianthus rupicola* subsp. *aeolicus* also occurs on the promontory of Capo Milazzo, *Helichrysum litoreum* occurs in some other Tyrrhenian Italian regions and both are included in the Red List of the Italian endemic flora (Orsenigo et al. 2020) as LC ("Least Concern").

This research also highlighted a high number of alien species (48) among the taxa sampled. Despite a recent study conducted by Stinca and co-workers (2021) in which it was stated that the introduction of alien species does not alter the ability to distinguish the Italian administrative regions on the basis of their total flora, the spread of invasive species poses a particular environmental threat on small islands of the Mediterranean Basin, which are hotspots of biodiversity and contain rare habitats and endemic species (Celesti-Grapow et al. 2016).

Nassella tenuissima has recently been planted for ornamental purposes near a winery and is spreading, probably by wind dissemination, to surrounding areas. It is strongly recommended to remove this species before it becomes naturalized on the island.

Gamochaeta pensylvanica (Willd.) Cabrera is a North American neophyte with increasing distribution in Italy. It was probably introduced as a weed by plant nurseries and was collected for the first time in Italy in 1980, and in Sicilia in 2015 (Ardenghi and Cauzzi 2015).

Oenothera odorata Jacq. (Onagraceae) is a naturalized species new to Italy. The population of Lipari was previously identified as *Oenothera stricta* Ledeb. ex Link subsp. *stricta* (Domina and Mazzola 2008). The current identification is based on a careful study of collected specimens according to Dietrich (1977) and has been confirmed by comparison with original material of *O. stricta* and *O. odorata*. The other Italian records currently referred to *Oenothera stricta* subsp. *stricta*, on our opinion, need to be verified.

Phyllostachys aurea Carrière ex Rivière & C.Rivière is being used as a living plant fence around a villa in Panarea and has started to reproduce vegetatively in the surrounding area.

Serapias nurrica Corrias subsp. *nurrica* is not reported in Pasta et al. (1999) and in the other available sources. It was found in Panarea, in the centre on the island, within old abandoned agricultural terraces and in Lipari on wasteland in the southern and western parts of the island.

Wahlenbergia lobeliodes (L.f.) Link subsp. *nutabunda* (Guss.) Murb. (Primulaceae) was newly found in Panarea on the Costa del Capraro about 120 years after the record by Lojacono-Pojero (1903) and about 40 years after the record by Brullo from Cala dei Zimmari (Brullo and Grillo 1985). This ephemeral taxon, occurring also in Sardegna and Calabria, has a very short vegetative cycle which makes it rarely reported.

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Supplementary material 1

Participants to the field trip

Authors: Giulio Barone, Enrico Bajona, Fabrizio Bartolucci, Laura Cancellieri, Giuseppe Caruso, Fabio Conti, Gianniantonio Domina, Simonetta Fascetti, Jacopo Franzoni, Valentina L.A. Laface, Lorenzo Pinzani, Leonardo Rosati, Anna Scoppola, Adriano Stinca, Agnese Tilia, Alessandro Crisafulli

Data type: pdf

Explanation note: Participants to the field trip of the Working Group for Floristics, Systematics and Evolution of the Italian Botanical Society (April 19th–22th 2022).

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Link: https://doi.org/10.3897/italianbotanist.16.113415.suppl1

Supplementary material 2

Public and private herbaria in which the collected specimens are kept

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Supplementary material 3

Inventory of the taxa collected or photographed during the field trip

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Data type: pdf

Explanation note: Field trip held in April 2022 in the islands of Lipari and Panarea (Aeolian Archipelago, Sicilia).

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Supplementary material 4

Selected photographs of taxa and landscapes shot

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